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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/608,116 | 06/30/2003 | Ho Seok Lee | 40296-0019 | 1036 |

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HELLER EHRMAN WHITE & MCAULIFFE LLP
1666 K STREET,NW
SUITE 300
WASHINGTON, DC 20006

EXAMINER

GURLEY, LYNNE ANN

| ART UNIT | PAPER NUMBER |
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2812

DATE MAILED: 12/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-------------------------------|----------------------------|--|
| Office Action Summary | Application No. 10/608,116 | Applicant(s) LEE ET AL. | |
| | Examiner Lynne A. Gurley | Art Unit 2812 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>10/103</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

2. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the term "predetermined" in line 5, which is indefinite.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for

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patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claim 1 is rejected under 35 U.S.C. 102(b) as being clearly anticipated by Liaw (US 6,239,014, dated 5/29/01).

7. Liaw shows the method as claimed in figures 1-3 and corresponding text as: (a) sequentially forming a capping layer 9 and a planarized interlayer insulating film 10 on a semiconductor substrate 1 having predetermined lower structure 7; (b) selectively etching the interlayer insulating film to expose a predetermined region of the capping layer; (c) removing the exposed capping layer (figures 3; column 3, lines 30-59); (d) subjecting the resulting structure to a plasma treatment using a mixture gas containing oxygen (plasma oxygen ashing; column 3, lines 59-61); and (e) performing a cleaning process (claim 1; column 3, lines 59-61).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

10. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

11. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liaw (US 6,239,014, dated 5/29/01) in view of Lee, "Characterization of the post dry-etch treatment for the cleanness of submicron contact hole bottoms", SEMI technology Symposium 2003, SEMICON Korea STS 2003, 1/22/03, pp. 57, 59 and 61-70).

Liaw shows the method as claimed and as described in the preceding paragraphs.

Liaw lacks anticipation only in not teaching that: 1) the plasma treatment is performed using a plasma of NF₃/O₂/He mixture gas, plasma of ar/O₂ mixture gas, plasma of CF₄/O₂ mixture gas or plasma of CF₄/O₂/Ar mixture gas (claim 2); 2) the step (b), (c), and (d) are performed in a same chamber without intermittence (claim 3); and 3) the step (d) is performed in an ex-situ process in a separate plasma chamber (claim 4).

Lee teaches an ex-situ cleaning process for contact holes between wordlines in DRAM structures using NF₃/O₂/He plasma to clean the contact bottoms.

It would have been obvious to one of ordinary skill to have used the cleaning plasma treatment taught in Lee to clean the contact holes in Liaw, with the motivation that both Liaw

and Lee teach a DRAM process and Lee's cleaning process intends to improve upon the reliability of the structure especially for sub-micron technology.

It would have been obvious to one of ordinary skill in the art to have performed the steps (b), (c) and (d) in situ in the method of Liaw, with the motivation that depending on the apparatus available, a cluster tool would improve the efficiency of the operation.

Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ngo et al. (US 6,562,416, dated 5/13/03) in view of Chung et al. (US 2002/0009893, dated 1/24/02) and further in view of Lee, "Characterization of the post dry-etch treatment for the cleanness of submicron contact hole bottoms", SEMI technology Symposium 2003, SEMICON Korea STS 2003, 1/22/03, pp. 57, 59 and 61-70).

Ngo shows the structure of the claimed invention with capping layer 12 and planarized dielectric layer 15, substrate 11, with existing structure 20.

Ngo lacks anticipation only in not teaching the oxygen plasma clean. Instead, Ngo teaches a nitrogen plasma clean.

Chung teaches an oxygen plasma cleaning step specifically for the case of having the low k dielectric layer made of FSG. The oxygen plasma treatment removes the residual fluorine from the low k layer before subsequent steps.

Lee teaches an ex-situ cleaning process for contact holes between wordlines in DRAM structures using NF₃/O₂/He plasma to clean the contact bottoms

It would have been obvious to one of ordinary skill to have used the cleaning plasma treatment taught in Chung to clean the contact holes in Ngo, with the motivation that if the low k

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layer in Ngo were FSG specifically, then Chung's cleaning process would further improve on the contact reliability.

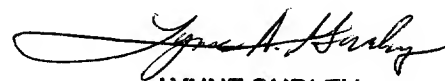
It would have been obvious to one of ordinary skill in the art to have used the plasma mixtures taught in Lee in the method of Ngo as modified by Chung, with the motivation that Chung teaches that nitrogen sources may also be present in the oxygen plasma.

It would have been obvious to one of ordinary skill in the art to have performed the steps (b), (c) and (d) in situ or the step(d) ex-situ in the method of Liaw, with the motivation that depending on the apparatus available, either a cluster tool would improve the efficiency of the operation, or separate apparatus may be the only means available.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne A. Gurley whose telephone number is 703-305-3474. The examiner can normally be reached on M-F 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on 703-308-3325. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 308-308-0956.


LYNNE GURLEY
PATENT EXAMINER
Art Unit 2812

LAG
December 9, 2003